JP-2000-147528E

[Title of the Invention] METHOD FOR MANUFACTURING LIQUID CRYSTAL DISPLAY DEVICE

[Abstract]

[Object] To realize a method for manufacturing liquid crystal display device capable of removing a positional deviation at the time of mutually sticking upper and lower substrates and removing defects such as uneven images.

[Solving Means] A lower substrate 3 whose upper surface is coated with an adhesive 1 and to which a liquid crystal (LC) material 2 is dropped is arranged in a vacuum container C, the whole lower surface is fixed by vacuum suction using a suction mechanism 5, an upper substrate 12 is arranged so as to be opposed to the lower substrate 3 at a prescribed interval, and the whole upper surface is fixed by vacuum suction using a suction mechanism 7. Then both the substrates 3 and 6 or either one of them are approached so as to bring the upper substrate 12 into contact with the liquid crystal material 2 or the adhesive 1 and both the substrates 3 and 6 are relatively moved in a substrate surface direction to align them. Then both the substrates 3 and 6 or either one of them are approached to each other and mutually pressurized to stick both the substrates 3 and 6 to each other.

[Claims]

[Claim 1] A method for manufacturing a liquid crystal display device the steps of arranging a lower substrate whose upper surface is coated with an adhesive and to which a liquid crystal material is dropped in a vacuum container and fixing the whole lower surface of the lower substrate with vacuum suction, arranging an upper substrate so as to be opposite to the lower substrate at a prescribed interval and fixing the whole upper surface of the upper substrate with vacuum suction, approaching both or either one of the substrates to each other so as to bring the upper substrate into contact with the liquid crystal material or the adhesive, relatively moving both the substrates in a substrate surface direction to align the substrates, approaching both or either one of the substrates to each other to pressurize both the substrates to each other, and sticking both the substrates to each other.

[Claim 2] A method for manufacturing a liquid crystal display device the steps of arranging a lower substrate whose upper surface is coated with an adhesive and to which a liquid crystal material is dropped in a vacuum container and fixing the whole lower surface of the lower substrate with vacuum suction, arranging an upper substrate so as to be opposite to the lower substrate at a prescribed interval and fixing the whole upper surface of the upper substrate

with vacuum suction, approaching both or either one of the substrates to each other at a prescribed interval location, relatively moving both the substrates in a substrate surface direction to perform pre-alignment, approaching both or either one of the substrates so as to bring the upper substrate into contact with the liquid crystal material or the adhesive, relatively moving both the substrates in a substrate surface direction to align the substrates, approaching both or either one of the substrates to each other to pressurize both the substrates to each other, and sticking both the substrates to each other.

[Claim 3] The method according to Claim 1 or 2, wherein the upper substrate is held at a location having a micro-gap with the adhesive when bringing the upper substrate into contact with the liquid crystal material or the adhesive.

[Claim 4] The method according to Claim 1 or 2, wherein an elastic body is interposed between the lower substrate and a vacuum suction mechanism.

[Claim 5] The method according to Claim 1 or 2, wherein, the suction of the lower substrate is released after the lower substrate and the upper substrate are stuck to each other.

[Claim 6] The method according to Claim 1 or 2, wherein the suction of the lower substrate is released after the lower substrate and the upper substrate are stuck to each

other, and the lower substrate and the upper substrate are temporarily fixed to each other by an ultraviolet ray curing type adhesive after the pressure of the vacuum container is returned to the atmospheric pressure.

[Claim 7] The method according to Claim 1 or 2, wherein the suction of the lower substrate is released and the pressure of the vacuum container is returned to the atmospheric pressure after the lower substrate and the upper substrate are stuck to each other and temporarily fixed to each other by an ultraviolet ray curing type adhesive.

[Claim 8] The method according to Claim 1 or 2, wherein the location of at least one of the upper substrate and the lower substrate is controlled by a controlling mechanism.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a method for manufacturing a liquid crystal display device used as an image display panel such as a personal computer or a television.

[0002]

[Description of the Related Art]

A conventional method for manufacturing a liquid crystal display device will be described with reference to Figs. 5 to 8.

[0003]

In the structure of the liquid crystal display device, as shown in Fig. 5, a regular gap is held between a lower substrate 11 and an upper substrate 12 which are opposite to each other and consist of light-penetrating material, a liquid crystal material 8 is filled in the gap, and both the substrates 11 and 12 are stuck to each other by an ultraviolet ray curing type adhesive 13. The adhesive 13 contains spacers 12 for holding regular interval (for example, a diameter of 5 μm) between the upper substrate 12 and the lower substrate 1

[0004]

As a method for arranging a liquid crystal material 15 in the adhesive 13, as shown in Fig. 6, there is a liquid crystal dropping method including coating the adhesive 13 on the lower substrate 11 with a predetermined thickness (for example, 30 μm) (process a), dropping the liquid crystal material 15 in the adhesive 13 (process b), superposing the upper substrate 12 on the lower substrate 11 and pressurizing both the substrates 11 and 12 until the interval between the upper substrate 12 and the lower substrate 11 becomes a predetermined value (for example, 5 μm) (process c), and irradiating ultraviolet rays 16 to the adhesive 13 to harden the adhesive 13 (process d) to complete a liquid crystal display device.

[0005]

Hereinafter, a method for sticking two substrates will be described in detail with reference to Figs. 7 and 8.

[0006]

First, the lower substrate 11 whose upper surface is coated with an ultraviolet ray curing type adhesive 13 with a thickness of 30 μm and to which a liquid crystal material 15 is arranged in the adhesive 13 is mounted on a table 17 which can be horizontally moved, and the whole lower surface thereof is fixed by a vacuum suction force of a suction mechanism 18 (process a). Next, the upper substrate 12 is arranged so as to be opposite to the lower substrate 11 at a prescribed interval and the whole upper surface thereof is fixed by a vacuum suction force of a suction mechanism 19 (process b). Next, the upper substrate 12 is lowered so that the interval between the upper substrate 12 and the lower substrate 11 becomes 1 mm, and a vacuum container C is closed (process c). Next, the table 17 having the lower substrate 11 mounted thereon is moved in a horizontal direction, the lower substrate 11 and the upper substrate 12 are aligned and the vacuum container C is evacuated (process d). Next, the upper substrate 12 is lowered to be brought into contact with the liquid crystal material 15 or the adhesive 13, is pressurized until the interval between the lower substrate 11 and the upper substrate 12 becomes 5 μm,

and is stuck to the lower substrate 11 through the adhesive 13 (process e). Thereafter, ultraviolet rays 16 are irradiated to the adhesive 13 to harden the adhesive 13 (process f), and thus the sticking operation of the lower substrate 11 and the upper substrate 12 is completed.

[0007]

[Problems to be Solved by the Invention]

However, in the conventional method, the upper substrate 12 and the lower substrate 11 are aligned so that the interval therebetween becomes 1 mm and then the upper substrate 12 is lowered by 1 mm to be brought into contact with the liquid crystal material 15 and the adhesive 13 and is pressurized in the vertical direction so that both the substrate are stuck to each other. Accordingly, the positional deviation is generated in the lowering and pressurizing operations.

[0008]

An object of the present invention is to provide a method for manufacturing a liquid crystal display device which can remove positional deviation when mutually sticking the lower substrate and the upper substrate and remove defect such as uneven images.

[0009]

[Means for Solving the Problems]

According to the present invention, there is provided a method for manufacturing a liquid crystal display device the steps of arranging a lower substrate whose upper surface is coated with an adhesive and to which a liquid crystal material is dropped in a vacuum container and fixing the whole lower surface of the lower substrate with vacuum suction, arranging an upper substrate so as to be opposite to the lower substrate at a prescribed interval and fixing the whole upper surface of the upper substrate with vacuum suction, approaching both or either one of the substrates to each other so as to bring the upper substrate into contact with the liquid crystal material or the adhesive, relatively moving both the substrates in a substrate surface direction to align the substrates, approaching both or either one of the substrates to each other to pressurize both the substrates to each other, and sticking both the substrates to each other. Since the alignment is performed after bringing the upper substrate into contact with the liquid crystal material and the adhesive, the state change due to the movement after the alignment is reduced and the moved distance is short. Thus, the positional deviation at the time of sticking the lower substrate and the upper substrate can be removed and thus defect such as uneven image can be removed.

[0010]

According to the present invention, there is also provided a method for manufacturing a liquid crystal display device the steps of arranging a lower substrate whose upper surface is coated with an adhesive and to which a liquid crystal material is dropped in a vacuum container and fixing the whole lower surface of the lower substrate with vacuum suction, arranging an upper substrate so as to be opposite to the lower substrate at a prescribed interval and fixing the whole upper surface of the upper substrate with vacuum suction, approaching both or either one of the substrates to each other at a prescribed interval location, relatively moving both the substrates in a substrate surface direction to perform pre-alignment, approaching both or either one of the substrates so as to bring the upper substrate into contact with the liquid crystal material or the adhesive, relatively moving both the substrates in a substrate surface direction to align the substrates, approaching both or either one of the substrates to each other to pressurize both the substrates to each other, and sticking both the substrates to each other. Thereby, the positional deviation at the time of sticking the lower substrate and the upper substrate can be removed and thus defect such as uneven image can be removed. Also, the movement amount of the lower substrate is reduced by the pre-alignment when performing the alignment and thus the adhesive is more

suppressed from being melted into the liquid crystal material.

[0011]

Also, since the upper substrate is held at a location having a micro-gap with the adhesive when bringing the upper substrate into contact with the liquid crystal material or the adhesive, the upper substrate and the lower substrate can be prevented from being tightly fixed to each other. Thus, a problem that the alignment can not be performed can be removed.

[0012]

Further, since the elastic body is interposed between the lower substrate and the suction mechanism, the gap between the upper substrate and the lower substrate can be obtained with high precision. Also, in this case, if the suction of the lower substrate is released after sticking the lower substrate and the upper substrate to each other, both the substrates are fixed by the suction mechanism of the upper substrate. Thus, the plane degree of both the substrates can be obtained with high precision.

[0013]

Moreover, since the suction of the lower substrate is released after the lower substrate and the upper substrate are stuck to each other, and the lower substrate and the upper substrate are temporarily fixed to each other by an

ultraviolet ray curing type adhesive after the pressure of the vacuum container is returned to the atmospheric pressure, the positional deviation of the upper substrate and the lower substrate can be surely prevented.

[0014]

Moreover, since the suction of the lower substrate is released and the pressure of the vacuum container is returned to the atmospheric pressure after the lower substrate and the upper substrate are stuck to each other and temporarily fixed to each other by an ultraviolet ray curing type adhesive, the positional deviation of the upper substrate and the lower substrate can be surely prevented.

[0015]

Also, since the location of at least one of the upper substrate and the lower substrate is controlled by the controlling mechanism, the upper substrate or the lower substrate can be surely fixed.

[0016]

[Description of the Embodiments]

Hereinafter, a method for manufacturing a liquid crystal display device according to a first embodiment of the present invention will be described with reference to Figs. 1 and 2.

[0017]

First, a lower substrate 3 whose upper surface is

coated with an ultraviolet ray curing type adhesive 1 with a thickness of 30 μm and to which a liquid crystal material 2 is arranged in the adhesive 1 is mounted on a table 4 which can be horizontally moved, and the whole lower surface of the lower substrate 3 is fixed by a vacuum suction force of a suction mechanism 5 (process a). Here, the lower substrate 3 consists of light-penetrating material.

[0018]

Next, the upper surface of a upper substrate 6 consisting of light-penetration material is fixed by a vacuum suction force of a suction mechanism 7, and a vacuum container C is closed and evacuated. Then, the suction mechanism 7 is lowered in the vertical direction to bring the upper substrate 6 into contact with the liquid crystal material 2 or the adhesive 1 (process b). Next, the table 4 having the lower substrate 3 mounted thereon is moved in a horizontal direction, the lower substrate 3 and the upper substrate 6 are aligned (process c)

[0019].

Next, the suction mechanism 7 is lowered in the vertical direction and the upper substrate 6 is pressurized so that the interval between the lower and upper substrates becomes 5 μm and is stuck to the lower substrate 3 through the adhesive 1 (process d). Thereafter, the substrates which are stuck to each other are carried out of the vacuum

container C and ultraviolet rays 8 are irradiated to harden to adhesive 1 (process e). Thus, the operation of sticking the lower substrate 3 and the upper substrate 6 is completed.

[0020]

According to this method, the alignment precision of the two substrates 3 and 6 which are opposite to each other can be suppressed to 1 μm or less and thus uneven images can be removed.

[0021]

Also, the thickness until the substrate is pressurized in the process d may be changed according to a diameter of spacers contained in the adhesive 1.

[0022]

Next, a method for manufacturing a liquid crystal display device according to a second embodiment of the present invention will be described with reference to Figs. 3 and 4.

[0023]

First, a lower substrate 3 whose upper surface is coated with an ultraviolet ray curing type adhesive 1 with a thickness of 30 μm and to which a liquid crystal material 2 is arranged in the adhesive 1 is mounted on a table 4 which can be horizontally moved, and the whole lower surface of the lower substrate 3 is fixed by a vacuum suction force of a suction mechanism 5 (process a). Here, the lower

substrate 3 consists of light-penetrating material.

[0024]

Next, the upper surface of a upper substrate 6 consisting of light-penetration material is fixed by a vacuum suction force of a suction mechanism 7, and a vacuum container C is closed and evacuated. Then, the upper substrate 6 is lowered so that the interval between the lower substrate 3 and the upper substrate 6 becomes 1 mm, and the table 4 having the lower substrate 3 mounted thereon is moved in the horizontal direction so that pre-alignment of the lower substrate 3 and the upper substrate 6 is performed (process b). Next, the suction mechanism 7 is lowered in the vertical direction to bring the upper substrate 6 into contact with the liquid crystal material 2 or the adhesive 1 (process c). Next, the table 4 having the lower substrate 3 mounted thereon is moved in a horizontal direction, the lower substrate 3 and the upper substrate 6 are aligned (process d)

[0025].

Next, the suction mechanism 7 is lowered in the vertical direction and the upper substrate 6 is pressurized so that the interval between the lower and upper substrates becomes 5 μm and is stuck to the lower substrate 3 through the adhesive 1 (process e). Thereafter, the substrates which are stuck to each other are carried out of the vacuum

container C and ultraviolet rays 8 are irradiated to harden to adhesive 1 (process f). Thus, the operation of sticking the lower substrate 3 and the upper substrate 6 is completed.

[0026]

According to this method, the alignment precision of the two substrates 3 and 6 which are opposite to each other can be suppressed to 1 μm or less and thus uneven images can be removed. Particularly, since the pre-alignment is performed, the movement amount of the lower substrate 3 is reduced when performing the alignment and thus the adhesive 1 is more suppressed from being melted into the liquid crystal material 2 according to the movement of the substrate.

[0027]

Also, the thickness until the substrate is pressurized in the process e may be changed according to a diameter of spacers contained in the adhesive 1.

[0028]

Further, in order to prevent the lower substrate 3 and the upper substrate 6 from being tightly fixed to each other by the adhesive 1 so that the alignment can not be performed, a mechanism for holding the gap between the upper substrate 6 and the lower substrate 3 to 100 μm from the height of the adhesive 1 may be further included so that the upper substrate 6 is brought into contact with only the liquid

crystal material 2 in the process c.

[0029]

In order to obtain the gap between the upper substrate 6 and the lower substrate 3 with high precision, an elastic body may be interposed between the lower substrate 3 and the suction mechanism 5. In case of having the elastic body, in order to obtain the plane degree of the stuck upper and lower substrates 6 and 5 with high precision, it is preferable that, after the lower substrate 3 and the upper substrate 6 are stuck to each other, the suction of the lower substrate 3 is released and the lower substrate 3 and the upper substrate 6 are fixed by the suction of the suction mechanism 7.

[0030]

Moreover, in order to prevent the deviation of the upper substrate 6 and the lower substrate 5 after the sticking operation, the suction of the lower substrate 3 may be released after sticking the lower substrate 3 and the upper substrate 6 to each other, and the upper substrate 6 and the lower substrate 3 may be temporarily fixed to each other after fixing the lower substrate 3 and the upper substrate 6 to each other by the suction of the suction mechanism 7 and returning the pressure of the vacuum container C to the atmospheric pressure.

[0031]

Also, in order to surely fix any one of the lower substrate 3 and the upper substrate 6, a mechanism for controlling the location of the substrate 3 or 6 may be further included.

[0032]

[Advantages]

According to the method for manufacturing the liquid crystal display device of the present invention, since the alignment is performed after bring the upper substrate into contact with the liquid crystal material or the adhesive, the state change due to the movement after the alignment is reduced and the moved distance is short. Thus, the positional deviation when sticking the lower substrate and the upper substrate can be removed and thus defect such as uneven image can be removed.

[0033]

Moreover, since both the substrates are approached to a prescribed interval location and the pre-alignment is performed, the positional deviation when sticking the lower substrate and the upper substrate can be removed and thus defect such as uneven image can be removed, and the movement amount of the lower substrate is reduced according to the pre-alignment when performing the alignment and thus the adhesive is more suppressed from being melted into the liquid crystal material.

[0034]

Also, since the upper substrate is held at a location having a micro-gap with the adhesive when bringing the upper substrate into contact with the liquid crystal material or the adhesive, the upper substrate and the lower substrate can be prevented from being tightly fixed to each other. Thus, a problem that the alignment can not be performed can be removed.

[0035]

Further, since the elastic body is interposed between the lower substrate and the suction mechanism, the gap between the upper substrate and the lower substrate can be obtained with high precision. Also, in this case, if the suction of the lower substrate is released after sticking the lower substrate and the upper substrate to each other, both the substrates are fixed by the suction mechanism of the upper substrate. Thus, the plane degree of both the substrates can be obtained with high precision.

[0036]

Moreover, since the suction of the lower substrate is released after the lower substrate and the upper substrate are stuck to each other, and the lower substrate and the upper substrate are temporarily fixed to each other by an ultraviolet ray curing type adhesive after the pressure of the vacuum container is returned to the atmospheric pressure,

the positional deviation of the upper substrate and the lower substrate can be surely prevented.

[0037]

Moreover, since the suction of the lower substrate is released and the pressure of the vacuum container is returned to the atmospheric pressure after the lower substrate and the upper substrate are stuck to each other and temporarily fixed to each other by an ultraviolet ray curing type adhesive, the positional deviation of the upper substrate and the lower substrate can be surely prevented.

[0038]

Also, since the location of at least one of the upper substrate and the lower substrate is controlled by the controlling mechanism, the upper substrate or the lower substrate can be surely fixed.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is a schematic cross-sectional view of processes of a method for manufacturing a liquid crystal display device according to a first embodiment of the present invention.

[Fig. 2]

Fig. 2 is a schematic cross-sectional view of the following processes of Fig. 1.

[Fig. 3]

Fig. 3 is a schematic cross-sectional view of processes of a method for manufacturing a liquid crystal display device according to a second embodiment of the present invention.

[Fig. 4]

Fig. 4 is a schematic cross-sectional view of the following processes of Fig. 3.

[Fig. 5]

Fig. 5 is a cross-sectional view schematically showing the structure of a liquid crystal display device.

[Fig. 6]

Fig. 6 is a schematic cross-sectional view of processes of a liquid dropping method of a liquid crystal display device.

[Fig. 7]

Fig. 7 is a schematic cross-sectional view of processes of a conventional method for manufacturing a liquid crystal display device.

[Fig. 8]

Fig. 8 is a schematic cross-sectional view of the following processes of Fig. 7.

[Reference Numerals]

1: adhesive

2: liquid crystal material

3: lower substrate

5: suction mechanism

6: upper substrate

7: suction mechanism

8: ultraviolet rays

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2000－147528
（Ｐ２０００－１４７５２８Ａ）
(43)公開日　平成12年５月26日(2000.5.26)

(51)Int.Cl.'	識別記号	Ｆ Ｉ		テーマコード（参考）
G02F 1/1339	505	G02F 1/1339	505	2H088
1/13	101	1/13	101	2H089

審査請求　未請求　請求項の数８　ＯＬ　（全７頁）

(21)出願番号　特願平10－324605

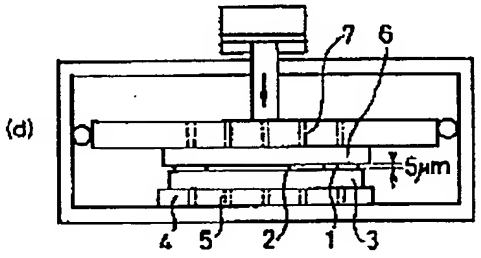
(22)出願日　平成10年11月16日(1998.11.16)

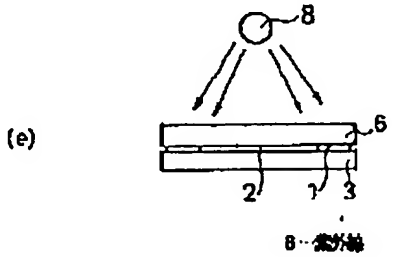
(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地
(72)発明者　江上　典彦
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　外園　信貴
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(74)代理人　100080827
弁理士　石原　勝

最終頁に続く

(54)【発明の名称】液晶表示素子の製造方法

(57)【要約】
【課題】　下基板と上基板の貼り合わせ時の位置ずれを無くし、画像むら不良を無くすことができる液晶表示素子の製造方法を提供する。
【解決手段】　上面に接着剤１が塗布され液晶材料２が滴下された下基板３を真空容器Ｃ内に配置して下側の全面を吸着機構５にて真空吸着して固定し、下基板３に対向するように所定の間隔で上基板６を配置して上側の全面を吸着機構７にて真空吸着して固定し、両方又は一方の基板３、６を接近移動させて上基板６と液晶材料２又は接着剤１を接触させた後、両基板３、６を基板面方向に相対移動させて位置合わせを行い、その後両方又は一方の基板３、６を接近移動させて相互に加圧し、両基板３、６を貼り合わせる。





1

【特許請求の範囲】

【請求項１】　上面に接着剤が塗布され液晶材料が滴下された下基板を真空容器内に配置して下側の全面を真空吸着して固定し、下基板に対向するように所定の間隔で上基板を配置して上側の全面を真空吸着して固定し、両方又は一方の基板を接近移動させて上基板と液晶材料又は接着剤を接触させた後、両基板を基板面方向に相対移動させて位置合わせを行い、その後両方又は一方の基板を接近移動させて相互に加圧し、両基板を貼り合わせることを特徴とする液晶表示素子の製造方法。

【請求項２】　上面に接着剤が塗布され液晶材料が滴下された下基板を真空容器内に配置しその下側の全面を真空吸着して固定し、下基板に対向するように所定の間隔で上基板を配置しその上側の全面を真空吸着して固定し、両方又は一方の基板を所定間隔位置まで接近移動させ、両基板を基板面方向に相対移動させて予備位置合わせを行い、その後両方又は一方の基板を接近移動させて上基板と液晶材料又は接着剤を接触させた後、両基板を基板面方向に相対移動させて位置合わせを行い、その後両方又は一方の基板を接近移動させて相互に加圧し、両基板を貼り合わせることを特徴とする液晶表示素子の製造方法。

【請求項３】　上基板と液晶材料又は接着剤を接触させる工程時に、上基板を接着剤との間に微小隙間が生じる位置に維持することを特徴とする請求項１又は２記載の液晶表示素子の製造方法。

【請求項４】　下基板と真空吸着する機構との間に弾性体を介装することを特徴とする請求項１又は２記載の液晶表示素子の製造方法。

【請求項５】　下基板と上基板を貼り合わせた後、下基板の吸着を解除することを特徴とする請求項４記載の液晶表示素子の製造方法。

【請求項６】　下基板と上基板を貼り合わせた後下基板の吸着を解除し、真空容器内の圧力を大気開放した後、ＵＶ硬化接着剤により仮止めを行うことを特徴とする請求項１又は２に記載の液晶表示素子の製造方法。

【請求項７】　下基板と上基板を貼り合わせ、ＵＶ硬化接着剤により仮止めを行った後、下基板の吸着を解除し、真空容器内の圧力を大気開放することを特徴とする請求項１又は２記載の液晶表示素子の製造方法。

【請求項８】　上基板と下基板の少なくとも一方の位置を規制機構にて規制することを特徴とする請求項１又は２記載の液晶表示素子の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、パーソナルコンピュータやＴＶ受像機等の画像表示パネルとして用いられる液晶表示素子の製造方法に関するものである。

【０００２】

【従来の技術】従来の液晶表示素子の製造方法について、図５～図８を参照して説明する。

2

【０００３】液晶表示素子の構造は、図５に示すように、対向配置された透光性材料からなる下基板１１と上基板１２との間に一定のギャップを保つとともにその間の空間に液晶材料１５を充填した状態で両者が紫外線硬化型の接着剤１３にて貼り合わされている。接着剤１３には下基板１１と上基板１２の間隔を一定に保つためのスペーサ１４（径５μｍ）が含まれている。

【０００４】このように液晶材料１５を接着剤１３の内側に配置する一方法として、図６に示すように、下基板１１に接着剤１３を厚み３０μｍで塗布した後（工程ａ）、接着剤１３の内側に液晶材料１５を滴下し（工程ｂ）、次に上基板１２を重ね合わせて上基板１２と下基板１１の間隔が５μｍになるまで加圧し（工程ｃ）、その後紫外線１６により接着剤１３を硬化させて液晶表示素子を完成させる液晶滴下工法がある。

【０００５】以下、上記２枚の基板の貼り合わせ方法について、図７、図８を参照して詳しく説明する。

【０００６】まず、表面に厚み３０μｍで塗布された紫外線硬化型の接着剤１３及びその接着剤１３の内側に液晶材料１５が配置された下基板１１を、水平方向に移動可能なテーブル１７上に搭載し、その下側の全面を吸着機構１８による真空吸着で固定する（工程ａ）。次に、下基板１１に対向するように所定の間隔で上基板１２を配置してその上側の全面を吸着機構１９による真空吸着で固定する（工程ｂ）。次に、上基板１２を降下させて上基板１２と下基板１１の間隔を１ｍｍにして真空容器Ｃを閉じる（工程ｃ）。次に、下基板１１を搭載したテーブル１７を水平移動して、下基板１１と上基板１２との位置合わせを行うとともに、真空容器Ｃ内の真空引きを行う（工程ｄ）。次に、上基板１２を降下させて上基板１２と液晶材料１５又は接着剤１３と接触させ、さらに下基板１１との間隔が５μｍになるまで加圧し、上基板１２を接着剤１３を介して下基板１１に貼り合わせる（工程ｅ）。その後、紫外線１６を照射して接着剤１３を硬化させ（工程ｆ）、下基板１１と上基板１２の貼り合わせが完了する。

【０００７】

【発明が解決しようとする課題】しかしながら、このような従来の方法では上基板１２と下基板１１の間隔を１ｍｍにして位置合わせを行い、その後上基板１２を１ｍｍ降下させて上基板１２を液晶材料１５と接着剤１３に接触させ、さらに上基板１２を垂直方向に加圧して貼り合わせるため、その降下、加圧時に位置ずれが発生するという問題があった。

【０００８】本発明は、上記従来の問題点に鑑み、下基板と上基板の貼り合わせ時の位置ずれを無くし、画像むら不良を無くすことができる液晶表示素子の製造方法を提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明の液晶表示素子の製造方法は、上面に接着剤が塗布され液晶材料が滴下された下基板を真空容器内に配置して下側の全面を真空吸着して固定し、下基板に対向するように所定の間隔で上基板を配置して上側の全面を真空吸着して固定し、両方又は一方の基板を接近移動させて上基板と液晶材料又は接着剤を接触させた後、両基板を基板面方向に相対移動させて位置合わせを行い、その後両方又は一方の基板を接近移動させて相互に加圧し、両基板を貼り合わせるものであり、上基板と液晶材料又は接着剤を接触させた後位置合わせを行うため、位置合わせ後の移動時の状態変化が少なくかつ移動距離が短いため、下基板と上基板の貼り合わせ時の位置ずれを無くして画像むら不良を無くすことができる。

【００１０】また、上面に接着剤が塗布され液晶材料が滴下された下基板を真空容器内に配置しその下側の全面を真空吸着して固定し、下基板に対向するように所定の間隔で上基板を配置しその上側の全面を真空吸着して固定し、両方又は一方の基板を所定間隔位置まで接近移動させ、両基板を基板面方向に相対移動させて予備位置合わせを行い、その後両方又は一方の基板を接近移動させて上基板と液晶材料又は接着剤を接触させた後、両基板を基板面方向に相対移動させて位置合わせを行い、その後両方又は一方の基板を接近移動させて相互に加圧し、両基板を貼り合わせるものであり、同様に下基板と上基板の貼り合わせ時の位置ずれを無くすことができて画像むら不良を無くすことができるとともに、予備位置決めによって位置決め時の移動量が少なくなるため接着剤の液晶材料への溶け込みを抑制できる。

【００１１】また、上基板と液晶材料又は接着剤を接触させる工程時に、上基板を接着剤との間に微小隙間が生じる位置に維持すると、接着剤にて上基板と下基板がくっついてしまって位置合わせができなくなる恐れを無くすことができる。

【００１２】また、下基板と真空吸着する機構との間に弾性体を介装すると、下基板が上基板の形状にならって上基板と下基板のギャップを高精度に得ることができる。また、その場合に下基板と上基板を貼り合わせた後、下基板の吸着を解除すると、上基板の吸着機構に両基板が固定されることにより、両基板の平面度を高精度に得ることができる。

【００１３】また、下基板と上基板を貼り合わせた後下基板の吸着を解除し、真空容器内の圧力を大気開放した後、ＵＶ硬化接着剤により仮止めを行うと、貼り合わせ後上基板と下基板がずれるのを確実に防止できる。

【００１４】また、下基板と上基板を貼り合わせ、ＵＶ硬化接着剤により仮止めを行った後、下基板の吸着を解除し、真空容器内の圧力を大気開放すると、貼り合わせ後上基板と下基板がずれるのを確実に防止できる。

【００１５】また、上基板と下基板の少なくとも一方の位置を規制機構にて規制すると、上基板又は下基板の固定を確実なものにできる。

【００１６】

【発明の実施の形態】以下、本発明の液晶表示素子の製造方法の第１の実施形態を図１、図２を参照して説明する。

【００１７】まず、表面に厚み３０μｍで塗布された紫外線硬化型の接着剤１及びその接着剤１の内側に液晶材料２が配置された透光性材料からなる下基板３を、水平方向に移動可能なテーブル４上に搭載し、下基板３の下側の全面を吸着機構５による真空吸着で固定する（工程ａ）。

【００１８】次に、透光性材料からなる上基板６の上側の全面を吸着機構７による真空吸着で固定し、真空容器Ｃを閉じて真空引きを行い、吸着機構７を垂直方向に下降させて、上基板６と液晶材料２または接着剤１を接触させる（工程ｂ）。次に、下基板３を搭載したテーブル４を水平方向に移動させて、下基板３と上基板６との位置合わせを行う（工程ｃ）。

【００１９】次に、吸着機構７を垂直方向に下降させて、上基板６を接着剤１を介して下基板３に貼り合わせ、５μｍまで加圧する（工程ｄ）。その後、真空容器Ｃから出し、紫外線８を照射して接着剤１を硬化させて、下基板３と上基板６の貼り合わせは完了する（工程ｅ）。

【００２０】この方法によれば、対向する位置に配置された２枚の基板３、６の位置合わせ精度を１μｍ以下に抑制でき、画像むらを無くすことができる。

【００２１】また、工程ｄでの加圧するまでの厚さは、接着剤１に含まれているスペーサの径に応じて変更してもよい。

【００２２】次に、本発明の液晶表示素子の製造方法の第２の実施形態を図３、図４を参照して説明する。

【００２３】まず、表面に厚み３０μｍで塗布された紫外線硬化型の接着剤１及びその接着剤１の内側に液晶材料２が配置された透光性材料からなる下基板３を、水平方向に移動可能なテーブル４上に搭載し、下基板３の下側の全面を吸着機構５による真空吸着で固定する（工程ａ）。

【００２４】次に、透光性材料からなる上基板６の上側の全面を吸着機構７による真空吸着で固定し、真空容器Ｃを閉じて真空引きを行い、上基板６を降下させて下基板３と上基板６の間隔を１ｍｍにし、下基板３を搭載したテーブル４を水平移動させて下基板３と上基板６の予備の位置合わせをする（工程ｂ）。次に、吸着機構７を垂直方向に下降させて、上基板６と液晶材料２または接着剤１を接触させる（工程ｃ）。次に、下基板３を搭載したテーブル４を水平方向に移動させて、下基板３と上基板６の位置合わせを行う（工程ｄ）。

【００２５】次に、吸着機構７を垂直方向に下降させ

て、上基板６を接着剤１を介して下基板３に貼り合わせ、５μｍまで加圧する（工程ｅ）。その後、真空容器Ｃから出し、紫外線８を照射して接着剤１を硬化させて、下基板３と上基板６の貼り合わせは完了する（工程ｆ）。

【００２６】この方法によれば、対向する位置に配置された２枚の基板３、６の位置合わせ精度を１μｍ以下に抑制でき、画像むらを無くすことができる。特に、予備の位置合わせを行っているので、位置合わせ時の下基板３の移動量が少なくなるため、移動による接着剤１の液晶材料２への溶け込みをより一層抑制することができる。

【００２７】また、工程ｅでの加圧するまでの厚さは、接着剤１に含まれているスペーサの径に応じて変更してもよい。

【００２８】また、下基板３と上基板６が接着剤１でくっついてしまって位置合わせができなくなるのを防止するため、上基板６と液晶材料２又は接着剤１を接触させる工程で液晶材料２にのみ接触させるように、上基板６と下基板３の隙間を接着剤１の高さから１００μｍに維持する機構を有してもよい。

【００２９】また、上基板６と下基板３のギャップを高精度に得るため、下基板３と吸着機構５の間に弾性体を介装してもよい。弾性体を有する場合、貼り合わせ後の上基板６と下基板３の平面度を高精度に得るため、下基板３と上基板６を貼り合わせた後、下基板３の吸着を解除し、上基板６の吸着機構７による吸着で固定するのが好ましい。

【００３０】また、貼り合わせた後上基板６と下基板３がずれないようにするため、下基板３と上基板６を貼り合わせた後、下基板３の吸着を解除し、上基板６の吸着機構７による真空吸着で固定し、真空容器Ｃ内の圧力を大気開放した後ＵＶ硬化接着剤により仮止めを行ってもよい。

【００３１】また、下基板３と上基板６の少なくとも一方の固定を確実なものとするために、それらの基板３、６を位置規制する機構を備えてもよい。

【００３２】

【発明の効果】本発明の液晶表示素子の製造方法によれば、以上のように上基板と液晶材料又は接着剤を接触させた後位置合わせを行うようにしたので、位置合わせ後の移動時の状態変化が少なくかつ移動距離が短いため、下基板と上基板の貼り合わせ時の位置ずれを無くして画像むら不良を無くすことができる。

【００３３】また、両基板を所定間隔位置まで接近移動させて予備位置合わせを行った後上記のように位置合わせすると、上記と同様の効果を奏するとともに、予備位置決めによって位置決め時の移動量が少なくなるため接着剤の液晶材料への溶け込みを抑制できる。

【００３４】また、上基板と液晶材料又は接着剤を接触させる工程時に、上基板を接着剤との間に微小隙間が生じる位置に維持すると、接着剤にて上基板と下基板がくっついてしまって位置合わせができなくなる恐れを無くすことができる。

【００３５】また、下基板と真空吸着する機構との間に弾性体を介装すると、下基板が上基板の形状にならって上基板と下基板のギャップを高精度に得ることができ、またその場合に下基板と上基板を貼り合わせた後、下基板の吸着を解除すると、上基板の吸着機構に両基板が固定されることにより、両基板の平面度を高精度に得ることができる。

【００３６】また、下基板と上基板を貼り合わせた後下基板の吸着を解除し、真空容器内の圧力を大気開放した後、ＵＶ硬化接着剤により仮止めを行うと、貼り合わせ後上基板と下基板がずれるのを確実に防止できる。

【００３７】また、下基板と上基板を貼り合わせ、ＵＶ硬化接着剤により仮止めを行った後、下基板の吸着を解除し、真空容器内の圧力を大気開放すると、貼り合わせ後上基板と下基板がずれるのを確実に防止できる。

【００３８】また、上基板と下基板の少なくとも一方の位置を規制機構にて規制すると、上基板又は下基板の固定を確実なものにできる。

【図面の簡単な説明】

【図１】本発明の液晶表示素子の製造方法における第１の実施形態の工程を示す模式的断面図である。

【図２】図１の後続工程を示す模式的断面図である。

【図３】本発明の液晶表示素子の製造方法における第２の実施形態の工程を示す模式的断面図である。

【図４】図３の後続工程を示す模式的断面図である。

【図５】液晶表示素子の概略構成を示す模式的に示す断面図である。

【図６】液晶表示素子の液晶滴下工法による製造工程を示す模式的断面図である。

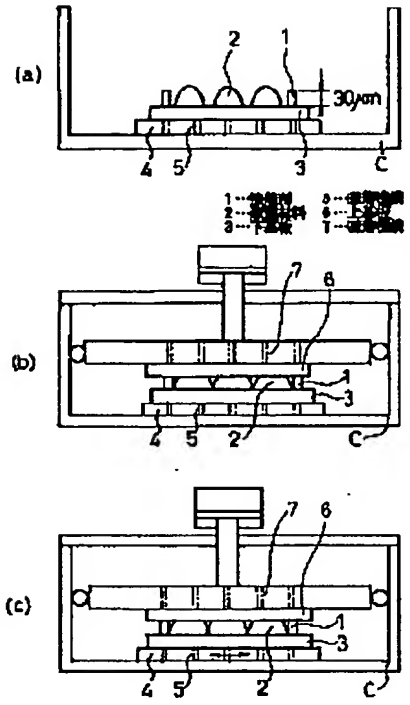
【図７】従来例の液晶表示素子の製造工程を示す模式的断面図である。

【図８】図７の後続工程を示す模式的断面図である。

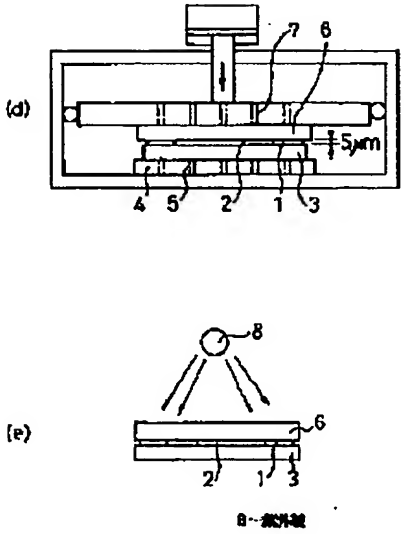
【符号の説明】

１　接着剤
２　液晶材料
３　下基板
５　吸着機構
６　上基板
７　吸着機構
８　紫外線

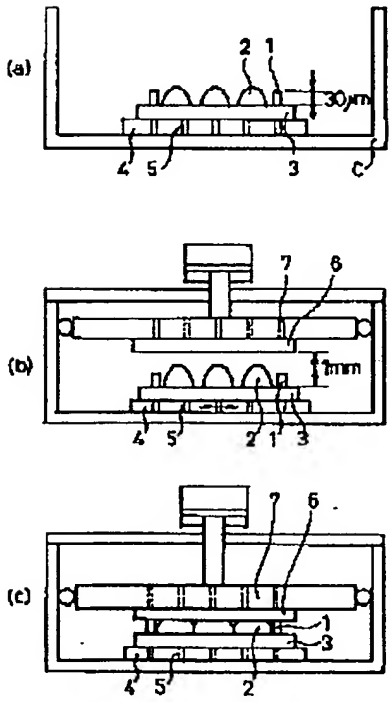
【図１】


(a)
2
1
30μm
4
5
3
C
(b)
7
6
1
3
4
5
2
C
(c)
7
6
1
3
4
5
2
C

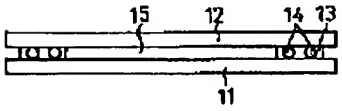
【図２】


(d)
7
6
5μm
4
5
2
1
3
(e)
8
6
2
1
3

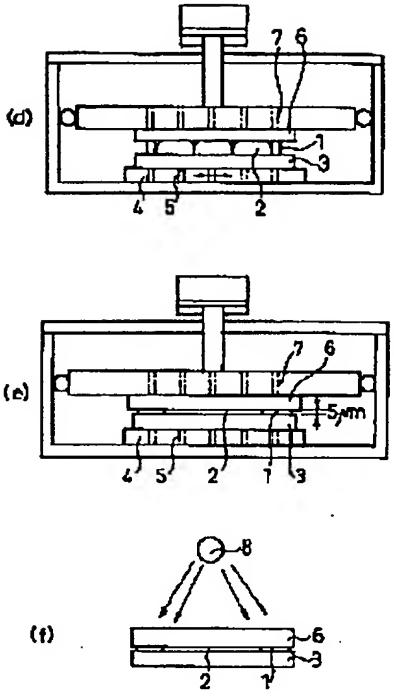
【図３】


(a)
2
1
30μm
4
5
3
C
(b)
7
6
1mm
4
5
2
1
3
(c)
7
6
1
3
4
5
2

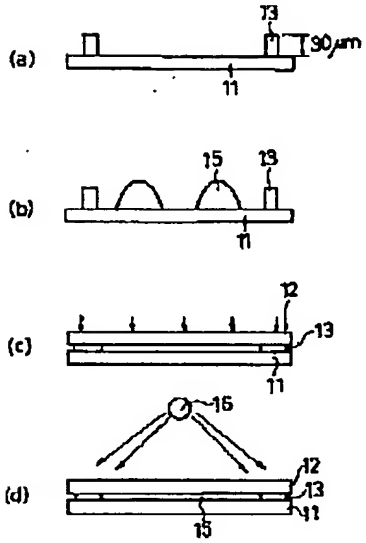
【図５】


15
12
14
13
11

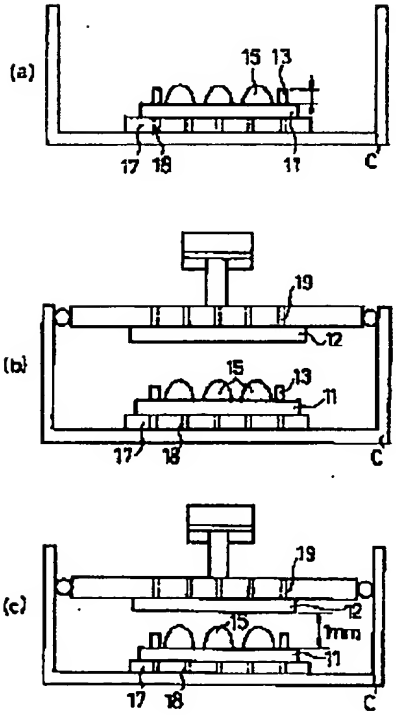
【図４】


(d)
7
6
1
3
4
5
2
(e)
7
6
5μm
4
5
2
1
3
(f)
8
6
3
2
1

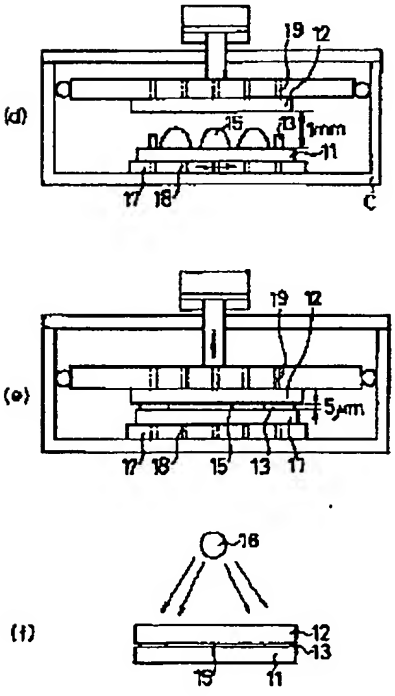
【図６】


(a)
13
30μm
11
(b)
15
13
11
(c)
12
13
11
(d)
16
12
13
11
15

【図７】


(a)
15
13
17
18
11
C
(b)
19
12
15
13
11
17
18
C
(c)
19
12
15
1mm
11
17
18
C

【図８】


(d)
19
12
15
13
1mm
11
17
18
C
(e)
19
12
5μm
17
18
15
13
11
(f)
16
12
13
15
11

フロントページの続き

(72)発明者　井上　進
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　炭田　祉朗
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　酒井　直人
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　松川　秀樹
大阪府門真市大字門真1006番地　松下電器産業株式会社内

Ｆターム(参考)　2H088 FA04 FA09 FA16 MA17 MA20
2H089 NA22 NA44 NA48 NA51 QA12
QA14